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Using Intelligent Agents Technology to Manage Food Chains

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ABSTRACT

For consideration for publication in

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The European Union (EU 15) is the world's largest producer of food and beverages, with combined production estimated (for 2001) at 675 billion Euros. In EU, 30.000 agribusiness companies, employing more than 2.800.000 employees, face increasing competition in terms of quality, price, and distribution efficiency. Structural changes are occurring in food supply chains and new supply designs and configurations are emerging. For example, the food industry has witnessed increasing collaboration in distribution. This food logistics re-engineering focuses upstream on distribution and retail chains. Therefore, automatic stock replenishment and deliveries are increasingly becoming the responsibility of producers; for example in WalMart (US & UK) & Tesco's (UK) supply chains.

Food supply chain re-engineering is facilitated by information technology (IT). The adoption of IT tools to optimise business processes. IT has been used to counter the losses in economies performance due to inefficient and inadequate processes in the supply chain [Ghisi et al, 2001]. State-of-the-art e-business technologies such as Agent Technology have presented encouraging results in fixing supply chain inefficiencies, thus contradicting the 'IT productivity paradox'.

This paper presents the design of a new intelligent software system that integrates information systems developed for relationships between enterprises and the final consumer (Business to Consumer or B2C) and between suppliers (Business to Business or B2B). The proposed theoretical model uses Agent Technology and will assist both the producing firm and the customer to look automatically for an increase in the data exchange rate.

Agent technology has successfully been used in the past for in managing business processes, as described in ADEPT (Advanced Decision Environment for Process Tasks) from Jennings [Jennings, 1998]. Based on the functionality of decision making from the company managers, the business process involves a combination of judgement and information from marketing, sales, research, development, and manufacturing and finance departments. Ideally all relevant information should be brought together before judgement is exercised. The ADEPT solves problems related to this process by viewing it as a community of negotiating, service-providing agents. Each agent represents a distinct role or department and is capable of providing one or more services.

Within this paper the term 'agent' corresponds to the software problem-solving entities, which are situated in a particular environment, with specified functions, in order to process the inputs received related to the problem domain. The agents have the ability to control their internal state and their behaviour, to exhibit flexible problem-solving techniques in pursuit of their design objectives. The intelligent agent software system is designed to fulfil the specific purpose of analysing the information about the customers that is available currently at the retailers' databases.

Usually each software agent is a different specialist, able to accomplish certain tasks, thus providing co-operative members in a society. In this work, the scenario of knowledge co-operation on our study based on Jennings et al. (1992), will illustrate how certain components (i.e. food supply agents) can be monitored from a multi-agent software system, by using intelligent specialised software agents, which will simulate the procedure of data analysis to extract useful information for the relationships between commercial partners. The key aspects of this work, based on the previous research in the field [Daskou et Mangina, 2003], are:

- The identification of possible market relationships has been mapped to a 'communication' problem where different kinds of agents seek to exchange messages to satisfy and interpret data on an on-line basis.
- The agents are autonomous entities and they either work on their own or co-operate with others.
- Every aspect of the scheduling process (from initial data acquisition to the relationships' interpretation) must be available to the user, in order to understand the internal process of the software.

This study illustrates how agent technology can be used to solve real food supply chain inefficiencies and optimise the logistics network, i.e. such as in the case of e-marketplaces. For instance, we explain how agribusiness companies can use agent technology to collect data from retailers, group them into meaningful categories, and then perform different functions. As a result, the distribution chain can be managed more efficiently. Intelligent agents also make available timely data to inventory management resulting in reducing stocks and tied capital. Intelligent agents are adoptive to changes so they are valuable in a dynamic environment where new products or partners have entered into the supply chain. This flexibility gives agent technology a relative advantage which, for pioneer companies, can be a competitive advantage. The study concludes with recommendations and directions for further research.

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